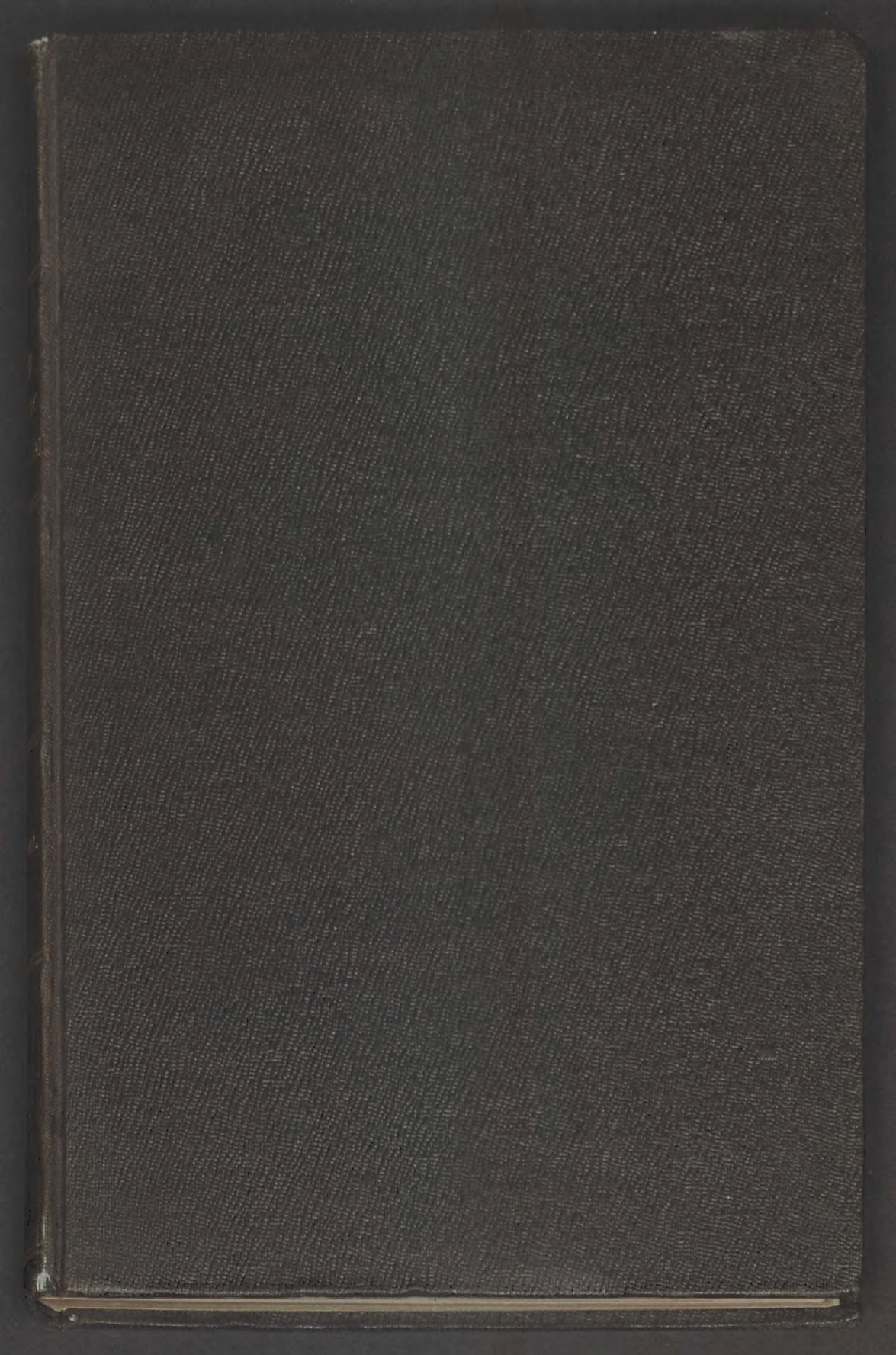
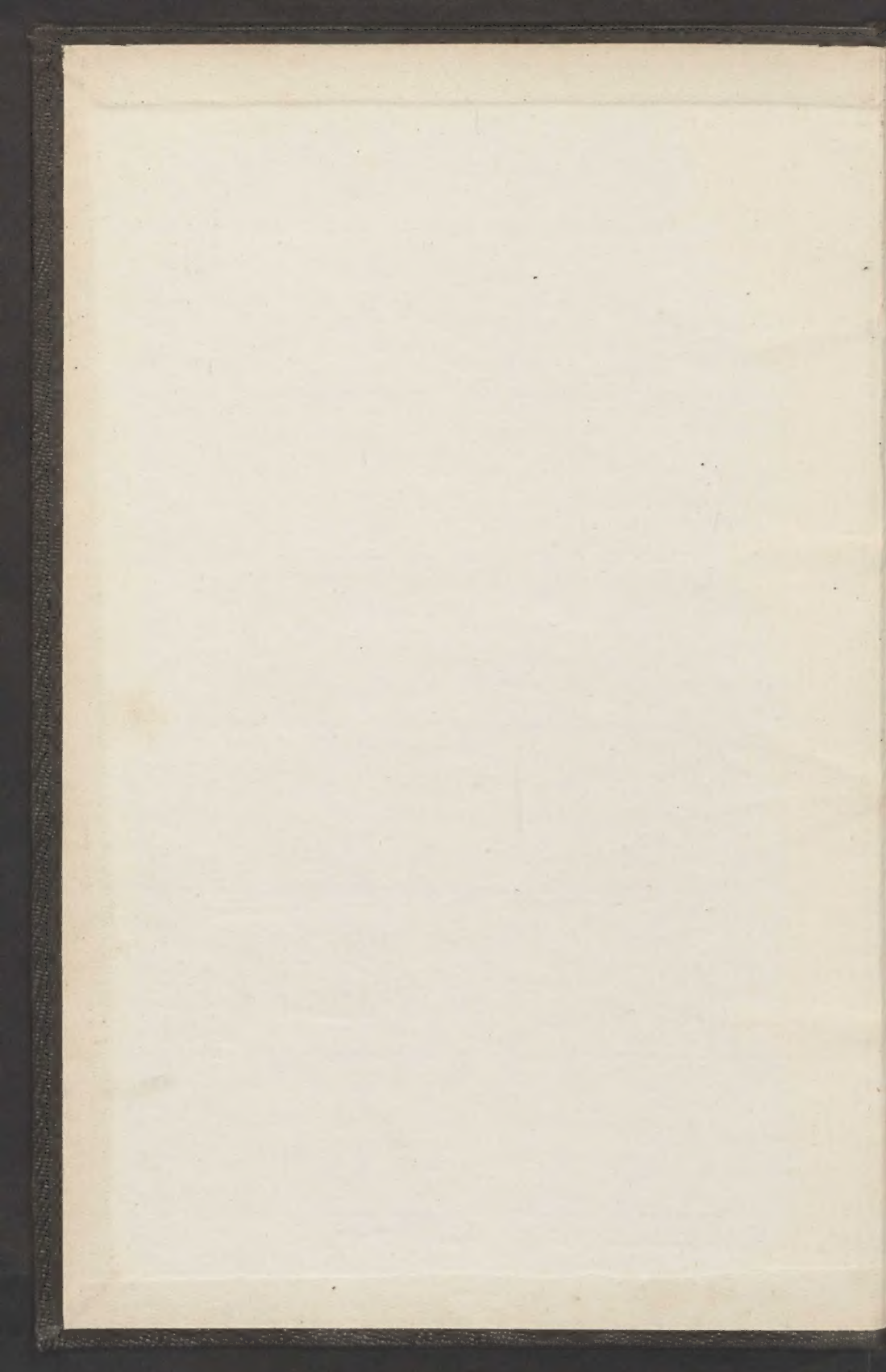
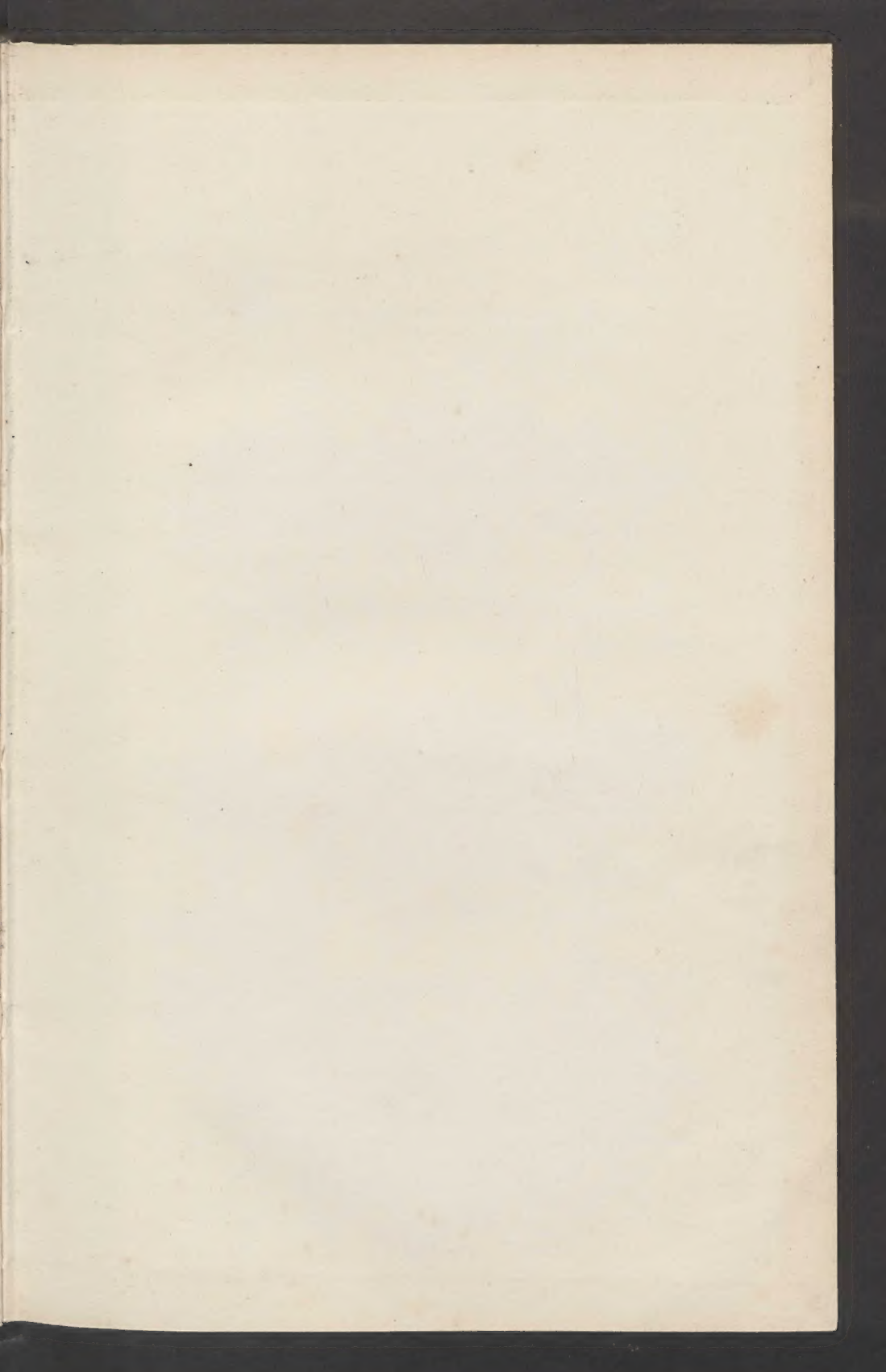










THE
NORTH ATLANTIC TELEGRAPH;

VIÂ
THE FARÖE ISLES, ICELAND, AND GREENLAND.

PRELIMINARY REPORTS
OF THE
SURVEYING EXPEDITIONS OF 1860,
ON THE
DEEP SEAS, LANDING-PLACES, LAND SECTIONS,
ETC., ETC., ETC.



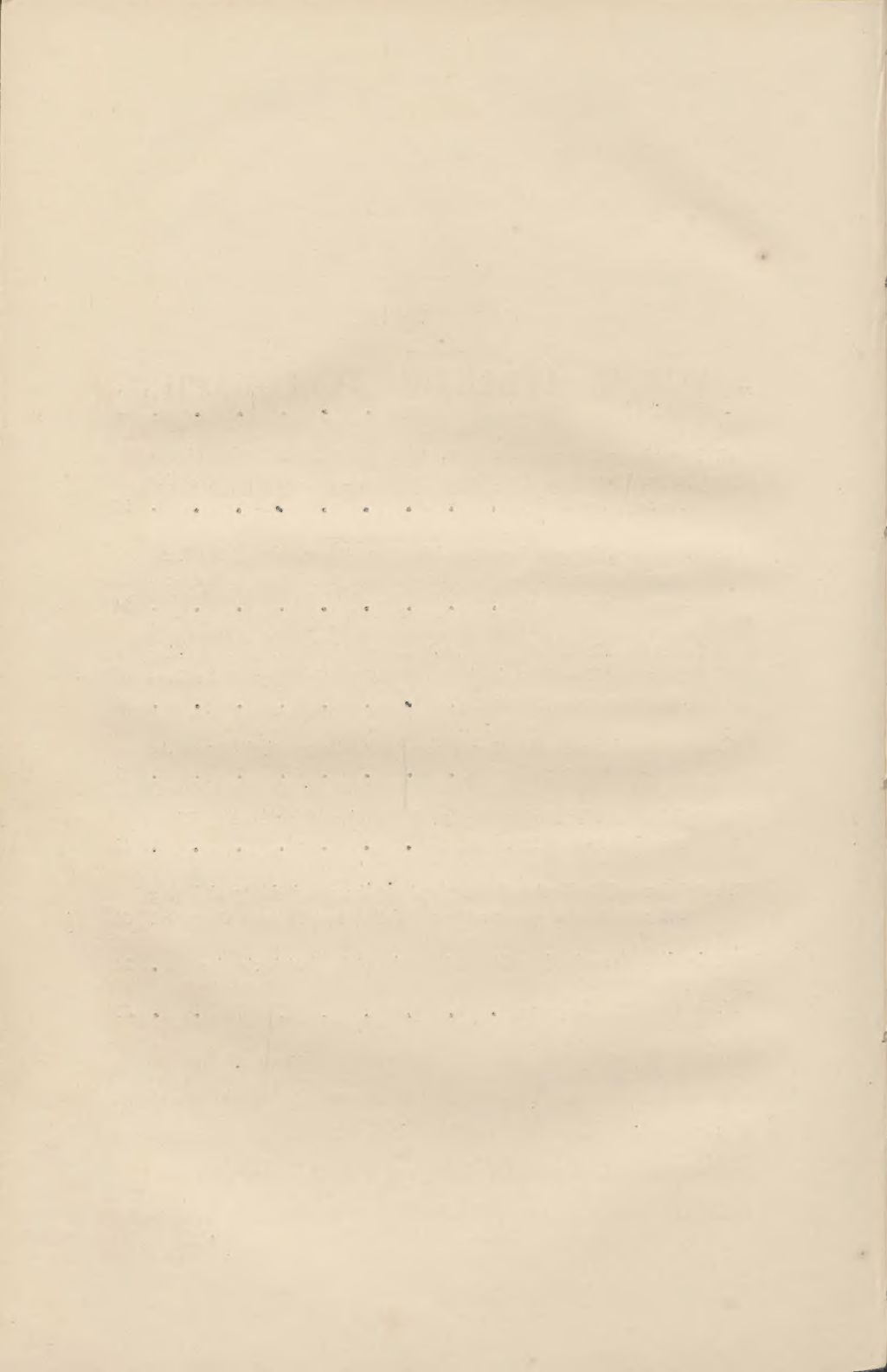
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THE
NORTH ATLANTIC TELEGRAPH;
VIA
FARÖE ISLES, ICELAND, AND GREENLAND.

IN advocating the establishment of Telegraphic Communication between this country and America, by a North Atlantic route, and in endeavouring to direct public attention to a line laid, as this will be, in short sections between Great Britain, the Faröe Islands, Iceland, Greenland, and Labrador, it is but right to state the grounds upon which the proposed route is deemed eminently practicable.

SUBMARINE TELEGRAPHY.

In 1851, after an experimental trial in the previous year, a cable of four conducting wires, protected by an outer casing of iron, was successfully laid down between Dover and Calais. This line has continued to carry a large proportion of the telegraphic business between this country and the continent of Europe for nine years; and may be instanced as an example of the durability of submarine lines, when they are well adapted in materials and construction to the character of the route along which they are laid. After this proof of the practicability of maintaining telegraphic

communication across the Channel, longer lines followed in rapid succession; and in a few years cables were successfully laid down from Great Britain to Ireland, Belgium, Holland, Hanover, Denmark, and the Channel Islands, each of which has done its part in conveying telegrams to and from this Island.

The idea of placing the Eastern and Western Continents in telegraphic communication with each other naturally arose out of these early successes; and in 1854 not only was the present route selected, but application was made to his Majesty the King of Denmark for the necessary permission to land on his territories; and a concession was obtained, bearing date August 16th of that year, which grants the exclusive privilege of using the Danish possessions of Greenland, Iceland, and the Farøe Islands, for a term of one hundred years. The advantages of the subdivision of the one great length into four sections were strongly urged by the promoters; but the proposition of direct communication between Newfoundland and Ireland was soon after brought before the commercial community so prominently, that in 1856 an influential association was formed for carrying out the direct Atlantic Line; and, in the summer of 1858, the cable was laid between Trinity Bay, Newfoundland, and the south-west coast of Ireland.

It soon became evident that this cable could not effect commercial telegraphy. Every effort to employ it was made, but in vain: its condition was hopeless, and to the regret of every one at the sad necessity it was eventually abandoned to its fate.

THE NORTH-ABOUT ENTERPRISE.

The time had now arrived when the original proposition of the North-about route, with all its peculiar claims, might hope to gain

the public ear, and to claim even greater consideration than it could have commanded originally. Because it had not only its own specialities precisely as they were, but it had been demonstrated, by experiment, that a direct line could not be expected to succeed as a commercial telegraph. The results of the experiments that have been made in submarine telegraphy, at the public expense, with a view to determine the best mechanical form and the most favourable electrical conditions of deep-sea cables, will be of the greatest importance to the northern enterprise. Add to this, the attention of men of science has been largely directed to these questions, and many public discussions have taken place; the result of all of which is that the mechanical requirements of a deep-sea cable, and the behaviour of electricity in conductors of this kind, are far better understood than they were; so that the Officers of the North Atlantic Telegraph will have no occasion to grope their way along untrodden paths without a chart, but will have a rich store of facts and experience to guide them in their course.

THE WYMAN EXPEDITION.

In 1859, Col. Shaffner chartered the bark Wyman, a vessel of 200 tons, and sailed from Boston, to survey the route of the proposed telegraph. The observations of this expedition are given in the speech made by him at a meeting of the merchants in Glasgow, in his papers read before the Royal Geographical Society in London, and the British Association in Oxford, and at his examination by the Committee on submarine telegraphy instituted by the Board of Trade of the British Government. It must be a source of very great satisfaction to that gentleman, as it is to his friends,

to find that the more recent surveys most singularly confirm those made by him the year previous. Unaided by government or capital, he went to test the practicability of the route, by personally examining the lands and fathoming the seas; and at the end of the voyage he gave to the world an amount of information in regard to the physics and the geography of the regions traversed that will be difficult for more extended expeditions to excel.

THE BULLDOG EXPEDITION.

In May of last year (1860), an influential deputation waited upon Lord Palmerston, with the view of obtaining from Her Majesty's Government the assistance of a vessel in order to make accurate soundings along the proposed line. The interview resulted in the Admiralty ordering the paddle steamer *Bulldog* to be commissioned for the purpose asked for, and Captain Sir Leopold M'Clintock was appointed to the command. The *Bulldog* was at once got ready for sea, and sailed from Spithead on the 24th of June, her mission being to survey the deep seas for the proposed telegraph.

The *Bulldog* returned to this country on the 11th November, after having most successfully carried out the object of her mission,—the taking of the deep sea soundings for the cable.

THE FOX EXPEDITION.

The steam yacht *Fox*, which played her part so successfully in the celebrated Franklin expedition, having been purchased by the promoters of the North Atlantic Telegraph, for the purpose of surveying the coasts and determining the several points at which

the cable shall be landed, Captain Allen Young was engaged to take the command.

The Fox was fitted out with every possible convenience for her interesting voyage. A complete set of meteorological instruments was presented by the Board of Trade, through the kindness of Rear-Admiral Fitzroy, F.R.S.; and a full supply of astronomical and mathematical instruments was lent by the Admiralty. She also carried out all the requisite appliances for the survey by sea and land.

Previous to the departure of the Fox, Her Majesty and the Prince Consort honoured her with a visit of inspection. On the 20th July, the Fox put to sea for the Farøe Islands, in order to select a favourable landing place for the cable. On leaving the Farøe Islands she proceeded direct to Iceland, making deep sea soundings by the way. Captain Young and his officers surveyed the east coast, and selected a favourable place for landing the cable; whilst the survey of the interior for the land line was simultaneously carried on by Dr. Rae and his party, consisting of Colonel Shaffner and Lieut. Von Zeilau. After visiting the west coast of Iceland, the Fox proceeded to the southern coast of Greenland, taking deep sea soundings and examining the various bays, for the purpose of determining the favourable point for the Greenland termini.

The Fox arrived on the 25th November, having been equally successful in making the land and coast surveys. The annexed preliminary reports of Capt. Allen Young and Dr. Rae, and the letter to Sir Charles Bright from Sir Leopold M'Clintock, which gives the results of the expeditions of 1860, will well repay a careful perusal. A map showing the tracks of the telegraph expeditions

of 1859 and 1860, and the soundings by Sir L. M'Clintock will also be found; the depths where the former Atlantic line was laid are also marked, by which it will be seen that the greatest depth in the North Atlantic is 392 fathoms less than the original line. The report also of Mr. Tayler, who returned to this country in the Bulldog from South Greenland, where he has resided for the last seven or eight years, in the neighbourhood of Julianshaab, is also appended, and is full of interest and instruction.

SECTIONALS OF THE ROUTE.

The distinctive features of the North Atlantic route are, its subdivision into four short sections, the respective lengths of which are as follows:—

I. Scotland to the Farøe Isles	. . .	225 miles.
II. Farøes to Iceland.		240 „
III. Iceland to Greenland		670 „
IV. Greenland to Labrador .		510 „
Total, proximate submarine sections .		1645 miles.

The cable will be in distinct lengths for each of these sections; so that should any derangement occur in one length of cable, the whole property will not be imperilled; and should cables be laid in duplicate, as they probably may be, and hereafter in triplicate, an uninterrupted through communication may at all times be insured, even during the repairs, should they be required, of one or more sections. The shortness of the lengths will make the laying of cables in duplicate a matter worthy of consideration as the undertaking proceeds. Profiles of the respective sea-sections and explanations are annexed, and they will be found worthy of study.

ELECTRIC CURRENTS IN SUBMARINE CABLES.*

Although there are four sections, it will by no means be necessary to re-transmit the messages at each point, but only to place there translators, or relays, and auxiliary battery power, which will enable London to communicate direct with America without a break, in the same manner that London at present communicates direct with Hamburg, Berlin, Vienna, Constantinople, and St. Petersburg, through the lines of the English Telegraph Companies, and the Continental system.

A staff of telegraph officials will be stationed at the termini of each section of cable, so that *through* communication by re-trans-

* Mr. Edward B. Bright, in a paper read at the British Association at Liverpool, in 1854, described some experiments instituted by himself and his brother, Sir Charles, for determining the velocity of ordinary working currents upon subterranean wires, the copper conductor being No. 16 gauge, and the gutta percha covering being No. 3 gauge. He found that one-third of a second elapsed between the contact at one end and the receipt of the current at the other, through 500 statute miles, and one second for 1000 miles.

In 1854, Col. Shaffner, after instituting some experiments in Europe, published, viz., "I will not say that a galvanic or magneto-electric current can never be sent from Newfoundland to Ireland; but I do say that, with the present discoveries in science, I do not believe it practicable for telegraphic service."

Professor Morse was on board of the Niagara in 1857, when the Atlantic cable broke some 380 miles from the Irish coast. In a letter he said, viz. :—

"We got an electric current through until the moment of parting, so that electric connexion was perfect; and yet *the further we payed out, the feebler was the current.*"

Mr. De Sautey was the electrician of the Atlantic Telegraph Company at Newfoundland, in 1858, when the cable was laid, and considered a success. He received the Queen's Message, and in a letter upon the subject, he states, viz. :—

"On reference to my journal, I find that the Queen's Message was commenced at 10.50 A.M. on the 16th of August, 1858, and was completed at 4.30 A.M. on the 17th; so that it occupied 17 hours and 40 minutes in its reception."

There were 99 words and 509 letters in the Queen's Message, and in its transmission it required, according to the above time, more than two minutes for each letter, or over ten minutes for each word.

mission can be obtained whenever it may be found desirable. The greatest distance from any one station to any other, including slack cable, will not exceed 800 miles. This is of vital importance in a commercial point of view, as compared with the two thousand or more miles necessarily laid for the direct communication between the two continents. The transmission of signals between Valentia and Trinity Bay during the brief existence of the Atlantic cable, is evidence to all the world that signals can be passed through a conductor of more than two thousand miles in length; yet the extreme slowness with which they passed was most discouraging, and would have cast a gloom over the prospects of that undertaking, however successful the results of laying the cable might have been. This retardation is in obedience to the laws of the propagation of electricity; and to work a cable of that length for commercial telegraphy is a problem that requires new discoveries in science to solve. There are certain inevitable effects, from which it is impossible to escape, and the duration of which varies in some proportion to the square of the length of the linear conductor—other things remaining the same. The simple act of dividing the cable into sections, as proposed, will increase its speaking capabilities, as compared with an undivided cable, at least six or eight fold. This is not all. Although it is beyond the power of our electricians to evade these inevitable laws, they will still be able, from the knowledge they now possess, so to construct the core that the effects will be greatly modified; or, to speak plainly, the time necessary for the transmission of consecutive signals will be still further diminished; and a cable of greater speaking power, length for length, than any heretofore constructed, will be obtained.

This improved speaking power is not confined within defined limits,—it may be made greater and greater, according as more or less cost is incurred in the original construction. A distinguished philosopher* who is well acquainted with the laws of electricity, and who is no mean authority on any matter to which these laws apply, while discussing these questions, in a work lately published, and evidently without being aware that a plan such as he proposes was so nearly organised, writes to this effect :—

“In presence of the inevitable effects, referred to above, we are justified in inquiring whether the establishment of a *direct* correspondence through the Atlantic Ocean by means of a cable of a *single length* is not a vain enterprise. The laws of the propagation of electricity along linear conductors seem to us to condemn for ever all attempts of this kind. We are convinced that America will one day be connected telegraphically with our Continent. Instead of endeavouring to extend between Europe and the New World a cable of a *single length* of more than two thousand miles, we must go out of the straight line, and carefully seek for intermediate stations of a nature such as to permit of the establishment of a series of relays, connected one with the other by conductors partially aerial and partially submarine ; success is to be obtained at this cost.”

REPORTS ON THE MARINE SECTIONS.

The promoters were encouraged by the surveys of 1859 and the opinions of many distinguished navigators to enter vigorously into the undertaking, and to take all proper measures to have a full and faithful survey made of the ocean route, and the coasts

* J. Gavarret, Professeur de Physique, à la Faculté de Médecine de Paris.

and bays; to visit and examine minutely every spot, and to select routes and landing-places. In prosecuting their plans they have been sorely tried by the severity, almost without a parallel, of the weather, which has marked in so peculiar a manner the year 1860. Inclement and ungenial it has been in England; tempestuous beyond measure was it in the northern seas! Besides this, the coasts of Greenland were beset with ice in a remarkable and exceptional manner. "Several intelligent Danish inhabitants of the colonies informed me," writes Mr. J. W. Tayler, "that more than thirty years had elapsed since there had been so much ice seen there and remaining so long." Add to this the opinions of the residents of Greenland, appended to this pamphlet, and the difficulties experienced by the telegraph expeditions of 1860 can be appreciated, as the most extraordinary ever known to occur upon the Greenland coasts. The surveying parties executed almost to the full their commission; and have rendered a most satisfactory account of their mission. They saw no obstacle of an uncommon character. They discovered nothing to affect the opinions that were given before their work was begun; on the contrary, they came home fully satisfied that with ordinary prudence the undertaking might be brought to a successful issue.

Captain Allen Young reported from the Farøe Isles:—"I find Thorshaven perfectly adapted for the reception of a cable; but as it would be liable to damage from anchors, I have selected an excellent little bay called Sandyyerde . . a cable might be landed, and lie in perfect repose on a sandy bottom and sandy beach, and perfectly land-locked." Then as to the other side of the Farøes;

“At Haldervig we surveyed harbour and fiord, and found all satisfactory; and I think that place to be well adapted for the reception of the cable. We found but little current, and the cable can be taken in, in a tolerable depth of water, into a perfectly land-locked position.” Then as to the practicability of landing on the east coast of Iceland: “We surveyed Berufjord, anchorage and bays, as far up as Guetavig, on the north shore, where I shall propose to land the cable. There will be no difficulties from sea-ice or otherwise.” In a letter, dated a few days later, he said: “Since writing to you on the 26th inst., I have examined Hvalfjord, near Reikiavik, west coast of Iceland, and Mariahaven; and find it well adapted for landing the cable; . . . the end of the cable can be taken on shore in Mariahaven, nine miles from entrance to fiord, on to a sandy beach, and where it will lie at repose and in a land-locked position.”

The practicability of Portland on the south of Iceland is referred to in the report of Dr. Rae, viz.: “By information received from some of the most intelligent and respectable gentlemen at Reikiavik, I am led to believe that Portland, on the south coast of Iceland, although not a harbour for vessels, is well fitted for the landing of a cable.”

With respect to landing at Greenland, Captain Young reports: “Returning with the Fox to Julianshaab, Oct. 27th, we then surveyed the estuary of the fiord; and from the soundings obtained, I am of a decided opinion that a *depth of not less than 150 to 160 fathoms* can be carried from the middle of the fiord, abreast the settlement, out to sea, with a general muddy bottom. *This depth of water will effectually preclude injury to the cable*

from the largest icebergs ever seen upon the coast. Although many bergs lay along the coast, we saw none aground in this valley of the fiord; nor, according to information obtained from the residents, have they been seen grounded in that channel." He further adds: "My decided opinion is favourable to the practicability of the undertaking; and that Julianshaab will, under all circumstances, be well adapted for the reception of the cable The ice *usually* dispersing from the south-east shores of Greenland in the autumnal months, opportunities will always occur when a ship, having the cable on board and lying in readiness in Julianshaab, may depend upon having a period of clear and open sea. *The cable once laid no drift ice can in any way injure it, if the proper precautions are taken in securing the shore end."*

We have still stronger encouragement at the hands of a gentleman, Mr. Tayler, a Fellow of the Geological Society, who has for seven years past actually resided in Greenland, and within the very district which had been considered by the promoters as most suited for landing the cable. He, of all men, is most qualified to give an opinion; because he can speak of the climate and the habits of the ice from an experience not of days or weeks, or even months, but of years. We have already given his evidence as to the anomalous character of the past season. He says, "I know that places do exist in Greenland at which the cable can be brought to land from depths of water so great, as to preclude the possibility of icebergs grounding upon it. Such places may be found between lat. 60° N. and 60° 20'; for example, Tessermiut Fiord, the large island of Sermisok, remarkable for the perpendicular

cliffs at its southern extremity ; and several other places, where the rocks are nearly perpendicular, and frequented by the birds in the breeding season." Further on he goes on to say, "The icebergs, therefore, which are formed in the fiords of S.W. Greenland do not ground, except in the shallower parts of the fiords ; and in the deeper parts there is no possibility of icebergs grounding in the depth of water, in which the cable would be laid." Then again, in regard to certain suggestions as to masses of stone likely to be liberated on the dissolution of icebergs :—"In the first place," he says, "not one berg in a thousand is seen to contain boulders ; in the second place, the temperature of the water is so near the freezing point, that but little of the bergs are melted on their passage round South Greenland ; and, in the third place, should such a thing occur, and a large boulder sink and fall upon the wire, I do not imagine that it would produce the least ill effect, since its specific gravity is but about 2·5, &c." As to the accessibility of the coast in respect to the ice, he adds : "The middle of September, when the ice gradually diminishes, until in the month of October the sea becomes free from ice, so much so, that but one or two straggling bergs can be seen from the highest mountains, &c. . . . It is, however, unnecessary to fear any impediments as regards the ice to laying the cable ; for the reason that the cable would not be laid to Greenland ; but, on the contrary, would be taken from thence to Iceland, round Cape Farewell on the one side, and to Labrador on the other." "I admit," he says, further on, "that vast quantities of ice are to be met with on the coast of Greenland ; but there is also a time when the sea is perfectly free from ice. I admit that icebergs draw much water, but I know that

the water is very much deeper, and that they cannot ground in the track of the cable."

Of like import is the evidence of Captain Sir Leopold M'Clintock. "South Greenland," he says, "is usually enveloped with drift-ice and icebergs, whilst in the autumn it is for the most part free. It is, however, liable to be more or less obstructed throughout the whole year; the present, for instance, has been an extremely bad one, probably the worst for thirty years: and yet the Bull-dog (paddle-steamer), the Fox (screw), and the Danish sailing vessels, have visited Julianshaab in September, October, and November. My humble opinion is, that in two years out of every three, the ice will be too inconsiderable to obstruct the laying down of a cable during the autumnal months."

The season of 1860 was so unusually severe, that the survey of the landing place on the Labrador coast was only partially accomplished. "Hamilton Inlet was rapidly explored," as remarked by Capt. Sir L. M'Clintock; "the main channel, for about half its entire length, sounded, and the whole laid down by Mr. Reed with sufficient accuracy for ordinary purposes; but these soundings are not nearly sufficient for the requirements of a cable." This inlet is 118 miles in length; and is very wide where it enters the sea; so that there is a large area to explore, and a wide field from which to select a route; and there is no reason to fear the result. On this point Sir L. M'Clintock remarks: "A perfect survey is requisite, and may show that the shoal water and reefs of rocks, which appear so intricate to us at present, can be avoided. I was told that the deepest channel lay to the north of George's Island, and between it and the Hern Islands. This is also the widest channel, measur-

ing not less than five miles. It is reported that large icebergs rarely drift into the mouth of the inlet, and only during easterly gales of long continuance; and that no icebergs ever come inside the Hern Islands."

Captain Sherard Osborn, who is a good authority on Arctic questions, before the sailing of the expeditions of 1860 stated:—"In a nautical and physical point of view, I know of no reasons why a cable should not connect the Canadas or Labrador with England. I am fully aware that ice streams down the coast of Greenland and Iceland; but I do not see in what way that will affect a small cable lying upon the bottom of the sea. . . . When it [floe ice] moves about it is afloat; and when afloat, there is always water enough beneath it to allow a cable of half-an-inch or more in diameter to lie undisturbed on the bottom of the sea. . . . A floating iceberg can never hurt a submerged cable, and even one grating or pressing along the bottom may, nine cases out of ten, fail to pick up a piece of rope embedded in the mud or sand; indeed, the probabilities are the cable would be only thrust still deeper into the bottom. Icebergs have not got claws or creepers; and I believe the cables across the narrow seas between England and Europe run fifty times more risk from the thousands of anchors, creepers and trawling-nets ever passing over them, than any cable would do under the Atlantic between Hamilton Inlet and Greenland."

REPORTS ON THE LAND SECTIONS.

With regard to the overland routes in the Faröes and in Iceland, there appear to be no difficulties. Dr. Rae says: "Having carefully examined the route, which was found perfectly

practicable for the passage of a telegraph wire," "from Thorshaven to Haldervig, a distance by the route we followed of about 27 miles." And of Iceland he says: "We took our departure from Berufjord, and after a journey of fourteen days' duration, having travelled 450 statute miles, reached this place (Reikiavik). The road, although not good, is such as a telegraph wire may be passed over and kept in order." "Although we by no means followed the shortest route, or that best adapted for telegraphic purposes, no obstacles, as far as I could notice, presented themselves to the erection of a telegraph wire." Lieut. Von Zeilau, and Mr. Olafsson, the Danish commissioners, concur in Dr. Rae's opinion, and say: "A line can be constructed across Iceland with all reasonable prospects of permanency." Sir L. M'Clintock writes: "I trust you will adhere to the original intention of a land line across Iceland to Faxe Bay, as by so doing you will avoid the only part of the sea where submarine volcanic disturbance may be suspected. Faxe Bay never freezes over, and I find no record of drift-ice within it since 1683. Merchant-vessels come and go throughout the winter."

DEPTHS OF THE SEAS.

The map and page of profiles of the respective sea sections which are annexed, will convey better than words a general idea of the deep-sea soundings. The distinguished officer appointed by the Admiralty to make a survey of the deep-seas, says, in regard to the first two sections: "As for the short lengths of cable between Scotland and Faröe, and from thence to the east shore of Iceland, no difficulties need be encountered. There are certain channels between the Faröe Isles where the tides are very

strong, but there are also still-water creeks, and these, I presume, will be selected for landing the shore-ends." In fact, he further remarks, that "there are no difficulties upon the sea route between Faröe and Iceland for the proposed cable." Upon the whole, he found the soundings shallower than he had been led to expect from the existing charts. The depth was generally less than 300 fathoms; the greatest depth is 682; no other sounding in the section reached 400.

The soundings generally between Iceland and Greenland were very regular; no depth exceeding 1572 fathoms was obtained, and this was found about mid-channel, as shown on the map, and the dip to this from either coast was progressive. A very fair line of soundings were completed from Greenland to Hamilton Inlet. The changes in depth were found to be uniform, the greatest depth being 2032 fathoms, or 392 less than the greatest in the Mid-Atlantic route. The soundings inserted on the map are taken from the chart published on the authority of the Admiralty.

Referring to the whole route, Sir L. M'Clintock says, "The contour of the sea-bottom and depth of the ocean throughout the route is decidedly favourable."

The soundings of the Ireland-Newfoundland route have been transferred from the Admiralty Chart to the map. They show the depths of a deep-sea route, along which a submarine cable *has been* laid. And, as there is no deep-sea difficulty so great in the proposed route, there is every reason to feel assured that a cable can be well and safely laid there; and the more so, as it will be deposited in distinct sections, the longest of which will be but little more than one-third of that of the cable formerly laid.

EXPENDITURES UNDER THE CONCESSION.

After having made the voyage to Greenland in 1859, and landed at Glasgow, Col. Shaffner learned that there were opposing interests endeavouring to effect the cancelment of his Concession in Denmark, on account of some alleged deficiency of formality with reference to one of the clauses of the Concession. After a discussion of the questions with the Minister at Copenhagen, it was stipulated that certain new conditions should be made in the Concession, so as to permit the line to be carried to North Scotland; that the expenses of Col. Shaffner, incurred, as the equivalent of a sum to be regarded as caution, should be abandoned; and that, within ninety days, 100,000 dols. Danish should be deposited with the government, in the form of a guaranty that the line should be constructed within the term of the Concession. Early after this new arrangement was made, Mr. Joseph Rodney Croskey, of London, was applied to for aid in the premises. That gentleman deposited the 100,000 dols. with the Danish government, purchased and fitted out the steamer Fox for the expedition of 1860, and besides these heavy outlays of moneys he has defrayed all other expenses of the enterprise up to the present time, and he has also given to the undertaking a degree of energy that has seldom marked the career of man.

The promoters have not brought this undertaking rashly or hastily before the public. It is evident from the Reports and other documents attached hereunto, indeed, it is a matter of public notoriety, that they have spared neither time, nor money, nor pains to satisfy themselves that the proposition of a North Atlantic

Telegraph is eminently practicable. They have shown their own confidence by the large outlay they have made in these preliminary and very necessary steps. They do not fear the issue. The establishment of telegraphic communication between the Old World and the New is a thing which must and will be accomplished. It is within the reach of ordinary prudence and foresight. They have surveyed the route, and have submitted the results to the public.

The company, when organised, will not be pledged to the adoption of any particular form of cable; but will be able to commence operations by a careful deliberation upon the most suitable description of cable for each separate length, aided by the counsel of the most experienced telegraphic engineers and electricians of the day; and from the comparative shortness of each length, responsible contractors can be found, who will manufacture, and lay down the cables, in perfect working order for the Company, taking the risk upon themselves.

THE
NORTH ATLANTIC TELEGRAPH
EXPEDITIONS, 1860.

SURVEYS OF THE LANDING PLACES

BY

ALLEN YOUNG, Esq.,

COMMANDER OF THE STEAM-YACHT "FOX" EXPEDITION.

PRELIMINARY REPORTS.

THORSHAVEN, FARÖE ISLES,
August 3rd, 1860.

DEAR SIRS,

As the mail probably leaves for home to-morrow, I take the opportunity to report our progress. We have had a tedious passage with contrary winds all the way, but I hope our good luck is to come. I have almost all our coals remaining, and am ready to start fair from here. In making these islands, we ran a line of soundings from some ten miles off into the north point of Naalsöe Island, a fine sandy bottom and shells, with depth varying from 35 to 26 fathoms. We anchored here to-day, and immediately commenced an examination of the locality. I find Thorshaven perfectly adapted for the reception of a cable, but as it would be liable to damage from anchors, I have selected an excellent little bay called Sandyyerde. This bay lies three quarters of a mile south of Thorshaven harbour, and there a cable might be landed, and be in perfect repose on a sandy bottom and sandy beach, and

perfectly land-locked. We have also run soundings across Naalsöe fiord, and the depth of water bottom and strength of stream are such as will perfectly admit of a wire being carried through it either by north or south into Sandyyerde bay or Thorshaven. The violent currents here are mere bugbears. I have narrowly watched both ebb and flood, and now in the strongest spring tides I cannot detect more than a three-knot stream in Naalsöe fiord. As M'Clintock has examined Westmanshaven, and in case that fiord might prove unfavourable, I go to Haldervig, near the north-west entrance to the fiord, dividing Stromöe and Osteröe, and indeed this appears to me the best point of departure from these islands. At any rate, we shall thus have two strings to our bow, that is both Westmanshaven and Haldervig. Shaffner and Rae cross the land to-morrow, and I pick them up the other side; and having surveyed Haldervig, I shall depart at once for Iceland. I hope you will pardon my writing you so short and hurried a letter, but I am completely tired with the day's work.

Yours very truly,

ALLEN YOUNG.

To JOSEPH R. CROSKY, Esq., and others,
Promoters of the
NORTH ATLANTIC TELEGRAPH.

Commander, &c. &c.

STEAM SURVEYING YACHT, "FOX,"

REIKIAVIK, ICELAND, *August 26, 1860.*

DEAR SIRS,

I wrote you briefly from Thorshaven, whence I proceeded through Westmansfiord, stopping at Westmanshaven. I there learned from the residents that M'Clintock had made examination of that harbour and the fiord, and so I proceeded at once to Haldervig, in the sound between Stromöe and Osteröe. In sounding north-west coast of Stromöe we were involved in a violent gale, which blew directly on to the land, and in carrying a press of canvas I lost fore top-sail yard and

head-gear in reefing; fortunately, however, we lost no lives, although five men were more or less bruised. At Haldervig we surveyed harbour and fiord, and found all satisfactory; and I think that place to be well adapted for the reception of the cable. We found but little current, and the cable can be taken in, in a tolerable depth of water, into a perfectly land-locked position.

Having received on board the travelling party from Thors-haven, I sailed from Haldervig for Berufiord, and sounded out to sea in direction (N. 58 W.) true, finding soundings regular, and gradually deepening to 195 fathoms 25 miles from land. We were then driven out of our course by a northerly gale and into position 624 fathoms; and this, I think, will be the deepest water between Farøe Islands and Iceland.

Approaching the coast of Iceland, I sounded in towards Ostrehorn, under which I anchored in a dense fog, and on following day weighed and got into position for running a line of soundings into Berufiord; and having accomplished which, we anchored at Djupivogr factory on August 12th.

Land travellers were then instructed to prepare for journey across Iceland to Reikiavik; and having completed necessary arrangements, and obtained a good supply of horses, they started on the 15th, under charge of Dr. Rae.

We surveyed Berufiord anchorage and bays as far up as Guetavig on north shore, where I shall propose to land the cable. There will be no difficulties from sea, ice, or otherwise; and the only obstacles will be from fogs and thick weather, but which may be overcome by selecting proper seasons, and taking precautions in landing or embarking the telegraph-cable.

I left Berufiord on the 17th inst., again sounding out to sea, then bore away for Westerman's Islands, and stopped there an hour or two last Sunday, the 19th inst., in order to gain information about Portland, &c. There is no harbour at Portland, and, indeed, none to my knowledge on south coast.

I arrived here on night of the 21st inst.; and having already filled up coal, water, and otherwise prepared for sea, I proceed to-morrow to Hvalfiord to examine that place, as apparently most favourable for bringing the cable here to land.

By the time I have finished this I hope the travellers will be on board, and I shall sail immediately after for Greenland.

I am getting all information from pilots and residents, and my officers are all doing their very best. All's well.

Yours very truly,

ALLEN YOUNG,

Commanding North Atlantic Telegraph Expedition.

To JOSEPH R. CROSKY, Esq., and others,
Promoters of the
NORTH ATLANTIC TELEGRAPH.

STEAM SURVEYING YACHT, "FOX,"

REIKIAVIK, ICELAND, *August 31, 1860.*

DEAR SIRS,

Since writing to you on the 26th inst. I have examined Hvalfiord and Mariahaven, and find it well adapted for landing the cable. The water in the fiord averages in depth from 25 to 18 fathoms, with soft muddy bottom, and the end of the cable can be taken on shore in Mariahaven, 9 miles from entrance to fiord, on to a sandy beach, and where it will lie at repose and in a land-locked position.

Our travellers across Iceland from Berufiord arrived on the 29th, and I enclose a copy of Dr. Rae's report, so far as he is at present able to make.

We were detained yesterday by a very heavy northerly gale, and I sail to-day for Greenland.

Believe me, yours very truly,

ALLEN YOUNG,

Commanding North Atlantic Telegraph Expedition.

To JOSEPH R. CROSKY, Esq., and others,
Promoters of the
NORTH ATLANTIC TELEGRAPH.

STEAM SURVEYING YACHT, "FOX,"

SOUTHAMPTON, November 28, 1860.

DEAR SIRS,

I beg to report the arrival of the "Fox" in Southampton Docks at 4 p.m. yesterday; and as my last communication with you was from Iceland, I now hand you a *preliminary* sketch of our proceedings, and report of survey, combined from the observations of both Mr. Davis and myself since leaving Reikiavik.

Having rated chronometers and swung ship for local deviation of compasses, we left Reikiavik, August 31st, and on following day were in position off the headland of Snœfell's Jökull, in N.W. extreme of Faxø Bay.

I had then intended making a course so as to strike the coast of Greenland in the same parallel of latitude, and carry the survey from that point down the coast to Cape Farewell. Our object being to examine the inlets and outlets upon the coasts, we did not delay for the purpose of deep sounding, but took advantage of every opportunity to obtain a cast and bottom specimens. At a distance from 60 to 160 miles, in a direction S., 57° W. from Snœfell's Næs, we obtained soundings of from 175 deepening to 1100 fathoms, the bottom being mud, specimens of which and of the water brought up by Six's thermometer cases were on all occasions preserved.

A series of gales, with heavy sea, now drove us from the desired course, and precluded us during the following days from making observations on the depth of the ocean. During these days every care was taken to ascertain the set of the Polar current, but by which we were not sensibly affected. In these gales we lost a portion of our bulwarks, staunchions, and deck gear; and although two of our men were seriously hurt, we fortunately lost no lives.

Our next opportunity for deep-sea sounding was on approaching the east coast of Greenland, when, at 130 miles

N., 75° E. from Cape Bille,* we got bottom in 1135 fathoms; and again, 1052 fathoms, with good specimens of mud, at a distance of 63 miles. We then carried in soundings to 170 fathoms, 10 miles from the land, Cape Bille bearing N., 40° W.

We had previously passed through some light streams of drift-ice; and on this day, September 12th, I filled up fresh water from a floe-piece, and then approached the land, the ice being close and heavy under the land; and in the evening, being surrounded with loose pieces, I kept away to southward along the shore, until daylight, when I stood in to about three miles off the high island called by the natives Omenarsuk. Some closely-packed ice lay here along the coast, the easterly wind keeping it upon the land; and seeing no opening to enable us to get in at that time, with no prospect of an off-shore wind to disperse it, I continued following the trend of the land and looking for an open harbour. Views of the land, angles and observations for fixing positions, &c., were obtained as we coasted along.

A dark *water-sky* off Lindenow fiord led me to hope that I should there be able to obtain anchorage; but in the afternoon of September 13th the wind freshened from S.S.W., and the weather began to threaten a repetition of the violent gales we had already experienced, and to bring back fresh ice from about Cape Farewell; and as the floe pieces were very close around the ship, and I saw no prospect of reaching a harbour on that evening, I had no alternative but to stand off for the

* Since the surveying voyage of Col. Shaffner to the east coast of Greenland in 1859, it has not been proposed to land the cable on that coast north of Prince Christian Sound, but to carry it into that fiord or channel. The object of the "Fox" in making the coast so far north was for the purpose of making all the observations possible that might be interesting in physical science. Heavy gales prevented the "Fox" from making Prince Christian Sound, and she proceeded to the west coast, where the surveys proved to be favourable for the landing of the Iceland and the Labrador cables in the same fiord.

night to the south-eastward. Two Polar bears were seen on this day, one of which I shot.

On the 14th we were in latitude 60° N., long. $40^{\circ} 10'$ W., 60 miles east from the entrance to Prince Christian Sound, having been led off by the trend of the ice, which now gave us the first indications of an unusually great accumulation around Cape Farewell, and which drove rapidly back to north-east before the wind. We here obtained soundings in 1120 fathoms, gravel and sand; and again on 16th, Cape Farewell bearing N. 56° W. 75 miles, 1230 fathoms, muddy sand.

From this date commenced a series of most violent gales, which blew without intermission until the evening of the 19th, and during which time I had on several occasions approached the coast, in order to ascertain if it was sufficiently free of ice to admit of our carrying on surveying operations in the southern fiords; and on the evening of the 21st September we moored to an iceberg for the night, we then being 36 miles S. 29° W. from Cape Thorvaldsen or Desolation Island, having worked through some streams of ice, and we took this opportunity of sounding. We got an unexpected depth of 1550 fathoms, but unfortunately lost the bottom specimen from the line fouling the ship's heel, and breaking at 300 fathoms in heaving in.

From the absence of ice in-shore we had intended with daylight entering the Torsukatok Channel, and proceeding within the islands to Julianshaab and southern fiords, but after midnight a furious hurricane from S.S.E. suddenly burst upon us, tearing us from the berg, and compelling us to scud before the wind, and through the openings in the ice, which now fast accumulated again from the southward. A detailed account of this hurricane will be given hereafter; suffice it to say, that after having frequently struck the ice, got the water over our machinery, and engines consequently stopped, storm-sail split, and upper works damaged, we were by the mercy of God's providence saved from destruction.

The northerly currents and continuance of stormy weather

prevented our reaching Frederickshaab until October 2nd, to which harbour I was obliged to go to repair damage, refit, and obtain fresh water.

After seeing to the necessary repairs, I organised a boat expedition to southward to examine the coast, and to ascertain if free from ice, which had hitherto constantly streamed northward along the land. Davis, Rae, Shaffner, Zeilau, and Woods accompanied me.

Having reached a good position southward, and there finding that the ice seaward had almost dispersed, I immediately returned, with the view at once to proceed on our voyage with the ship. We sailed from Frederickshaab on October 20th, with strong northerly gale, and on following day passed through the Torsukatok Channel, reaching Julianshaab on 22nd, and on ascending the neighbouring hills, from the height of 1000 feet not a piece of drift oceanic ice was to be seen around the coast.

Having made all inquiries about Igalikko (Julianshaab) Fiord, I deemed it advisable at once to commence a survey of this beautiful arm of the sea, and acting upon the opinion of Colonel Shaffner, that were this fiord found practicable the electric circuit from Reikiavik would not be too extended.

We first sounded up to the head of the fiord, which gave an opportunity for our landing a travelling party, under command of Dr. Rae, to examine the *inland-ice* and nature of the country. A party also went to the Old Nordisker ruins at Igalikko.

Returning with the "Fox" to Julianshaab, Oct. 27th, we then surveyed the estuary of the fiord, and from the soundings obtained I am of a decided opinion that a *depth of not less than 150 to 160 fathoms* can be carried from the middle of the fiord, abreast the settlement, out to sea, with a general muddy bottom. *This depth of water will effectually preclude injury to the cable from the largest icebergs ever seen upon the coast.*

Although many bergs lay along the coast, we saw none

aground in this valley of the fiord, nor, according to information obtained from the residents, have they been seen grounded in that channel.

These operations occupied us till November 2nd, when winter had fairly set in. The temperatures were lower than are usually experienced in midwinter, and the fiord, which seldom freezes, was already covered with thin ice for sixteen miles from the head. Nevertheless, I had intended, had we been all on board, to have proceeded with the last of the moon to Parmiedluk, in order also to examine Illoa Fiord, but our anxiously-expected travelling-party from the *inland-ice* had not returned, and I immediately left the ship with boat and sledge in search of them, and found them at Igalikko. We all returned on board on Nov. 6th.

All surveying operations for this season were now at an end: the moon had gone, and the new ice, forming fast inside the islands, put a stop to further navigation upon the coast; and as it was also too late to get into Hamilton Inlet, I determined at once to proceed to England, and accordingly on Nov. 8th sailed from Julianshaab, passed through some drift-ice in the night, and, after a fair run under canvas across the Atlantic, anchored in Portland Roads on Nov. 23rd.

I much regret that the unusual severity of the season, and the consequent uncertainty of the navigation, prevented my carrying out our earnest desires to meet Sir Leopold M'Clintock.

This Report, and my previous letters, though necessarily brief, will show that my decided opinion (so far as we have been upon that route) is favourable to the practicability of the undertaking; and that Julianshaab will, under all circumstances, be well adapted for the reception of the cable. With regard to the operation of laying the cable, I consider that no apprehension may be felt on that point, for the sudden disappearance which we witnessed of the ice from the coast, and from the ice *usually* dispersing from the south-east shores of Greenland in the autumnal months, opportunities will always

occur when a ship, having the cable on board, and lying in readiness in Julianshaab, may depend upon having a period of clear and open sea. *The cable once laid, no drift-ice can in any way injure it, if the proper precautions are taken in securing the shore end.*

As soon as the detail of the survey, with astronomical observations, has been worked up, and when our meridional distances are ascertained, a further report, with charts, drawings, meteorological register, &c., will be submitted to you.

Although this is only a preliminary Report, I cannot refrain from expressing my gratitude to all the officers attached to the expedition, who have exerted themselves to their best; also to those in the Government departments, from whom I have received the most valuable assistance, and to whom I shall again refer in my detailed Report. I have brought home an Esquimaux hunter, and hope to teach him the English language, in order that we may have a direct interpreter in the future operations in Greenland.

I am thankful to say, that on arrival in England we had not a case of sickness on board, although several accidents occurred during the heavy weather we experienced. I have not lost one of my fine crew.

I have the honour to be, Sir,

Your most obedient Servant,

ALLEN YOUNG,

Commander of the North Atlantic Telegraph Expedition.

J. R. CROSKY, Esq., and others,

Promoters of the

NORTH ATLANTIC TELEGRAPH.

Captain Young having submitted the above sketch of our voyage from Iceland to my consideration, I perfectly share in the opinion expressed therein as to the *practicability of the route.*

J. E. DAVIS,

Master and Surveyor, R.N.

STEAM SURVEYING YACHT, "FOX,"

SOUTHAMPTON, November 30, 1860.

SURVEYS OF THE LAND SECTIONS

BY

DR. JOHN RAE,

COMMANDER OF THE LAND EXPEDITIONS.

PRELIMINARY REPORTS.

REIKIAVIK, ICELAND, *29th August, 1860.*

GENTLEMEN,

I have the honour to inform you that we arrived at Thorshaven, in the Faröe Islands, on the 3rd inst., after a safe but rather long passage from Scotland. Next day, having obtained two guides, Col. Shaffner, Lieut. Zeilau, and myself, commenced a journey overland to Haldervig, at the north end of Stromöe, where we arrived on the 6th, having carefully examined the route, which was found perfectly practicable for the passage of a telegraph wire. A road for pack-horses already exists along the whole route, and may be easily improved. The Sound between Stromöe and Osteröe is close to a large portion of the way, and is navigable for boats and small vessels, offering facilities for the transport of material.

We sailed from Haldervig on the 7th August, and arrived at Beruford, on the east coast of Iceland, on the 12th.

It occupied nearly three days in obtaining guides and purchasing horses for travelling across country to Reikiavik. On the 15th, Col. Shaffner, Lieut. Zeilau, and I, took our departure from Beruford, and after a journey of fourteen days' duration, having travelled 450 statute miles, reached this

place. The road, although not good, is such as a telegraph wire may be passed over and kept in order, although expensive in some places.

The results of my observation for altitudes, &c., shall be embraced in my more detailed report, which shall be forwarded to you as early as possible.

I have the honour to be,
Your very obedient Servant,

JOHN RAE,
Commanding Land Expedition.

To JOSEPH R. CROSKY, Esq., and others,
Promoters of the
NORTH ATLANTIC TELEGRAPH.

LONDON, 14th December, 1860.

GENTLEMEN,

Having engaged to take charge of the land portion of the Expedition for the examination of the North Atlantic Telegraph route, and to report to you my observations thereon, I have now the honour to inform you that my full and detailed report is drawn up, and subject to your order at any moment. I have only awaited the completion of the enlarged maps of the respective lands traversed, which have been requested since my return, and which are still in progress of construction. For the present I will confine myself to a very brief summary of the results of my own observations, and of such reliable information collected *en route* as may in future be of use to the enterprise.

After a tedious passage of fourteen days from England, we reached Thorshaven, the capital of the Faröes, on the 3rd of August. The three following days were spent in travelling over the island of Stromöe, in a north-westerly direction from Thorshaven to Haldervig, a distance by the route we followed of about 27 miles.

The results of this short journey were very satisfactory, and

showed that there would be no great difficulty in carrying a telegraph wire over the line of route by which we passed. The Sound which separates Stromöe from Osteröe offers great facilities for the transport of materials. The transport overland is by pack-ponies. They are sure-footed, and can carry a load of 200 lbs. or more. Footpaths already exist, which could be much improved at a very moderate expense. The inhabitants of the Faröes are hospitable, well educated, and intelligent; and would give all the aid in their power to carry out this great undertaking, in which all whom I conversed with took a deep interest.

The journey across Iceland from Berufjord on the east to Reikiavik on the west coast, commenced on the 15th August, and occupied 14 days; the distance travelled over being little, if at all, short of 450 miles. During this journey, although we by no means followed the shortest route, or that best adapted for telegraphic purposes, no obstacles, as far as I could notice, presented themselves to the erection of a telegraph wire. As we kept well to the northward, all the streams of any size crossed by us (with one exception) flowed in that direction; and high, well-defined banks, which showed no indication of ice action, or of shifting their position, as I am told is a peculiarity of the rivers flowing into the sea on the south coast of the island.

By information received from some of the most intelligent and respectable gentlemen at Reikiavik, I am led to believe that Portland, on the south coast of Iceland, although not a harbour for vessels, is well fitted for the landing of a cable, the beach being of fine sand. There is frequently a heavy surf, but this, I am told, would not injure a strong cable laid upon a shore of the nature described.

The modes of transport of stores over Iceland are by ponies, and in some places waggons and sledges may be used.

The lowest temperature experienced during winter is 13° or 14° below zero of Fahrenheit, and this is of rare occurrence.

I regret to say that our visit to Greenland, as far as regards the land part of the Expedition, was very limited in consequence of the lateness and unusual severity of the season.

I had no opportunity of examining the inland ice to any extent, so that I cannot give an opinion on the practicability of carrying a wire or cable across any part of South Greenland; nor do I think this of much importance, as I believe the doing so will not be found requisite or advantageous.

From my own observation, and from information obtained from the most reliable sources, I do not believe that the ice, either in the form of floe or bergs, can injure a cable if once down; and that in ordinary seasons a cable may be laid without much difficulty.

That the dangers to ships from ice are not generally considered very great in the South Greenland seas, may be inferred from the fact that vessels, sometimes numbering ten or twelve in the season, visit this coast, and generally return laden to Europe in perfect safety and uninjured. Most of these vessels are not strengthened to protect them from ice.

Col. Shaffner and Lieut. Von Zeilau (one of the Danish Commissioners) accompanied me on the journeys across Stromøe and Iceland; and I cannot close this brief letter without expressing the deep sense of obligation I am under to these gentlemen: to the former for his excellent practical advice and counsel in any case of difficulty; to the latter for his zeal and energy in general, and especially for the valuable services arising from his perfect knowledge of the languages of the people among whom we travelled.

I have the honour to be, Gentlemen,

Your very obedient Servant,

JOHN RAE,

Commander of the Land Expedition.

To JOSEPH R. CROSKY, Esq., and others,

Promoters of the

NORTH ATLANTIC TELEGRAPH.

OPINION
OF
CAPTAIN SIR F. LEOPOLD M'CLINTOCK, R.N.,
IN FAVOUR OF THE PRACTICABILITY OF
THE NORTH ATLANTIC TELEGRAPH ROUTE.

PORTSMOUTH, 6th December, 1860.

MY DEAR SIR CHARLES,

You are very welcome to my opinion respecting the North Atlantic Telegraph Route. It has been formed solely upon what I have recently seen, and upon the local information I have gleaned, whilst employed in sounding and surveying along the projected route in command of H.M.S. "Bulldog."

As for the short lengths of cable between Scotland and Farøe, and from thence to the east shore of Iceland, no difficulties need be encountered. There are certain channels between the Farøe Isles, where the tides are very strong; but there are also still-water creeks, and these, I presume, will be selected for landing the shore-ends.

Like most of my countrymen, I was profoundly ignorant of the climatic condition of Iceland before I went there; and being desirous of obtaining authentic information respecting the ice movements in the adjacent seas, a scientific gentleman to whom I had an introduction kindly met my wishes by hunting up for me such facts as I required from the celebrated "Icelandic Annals," which date back as far as the ninth century. Briefly, then, the shores of Iceland are only

visited by drift-ice about seven or eight times in each century ; and it is only upon two or three of these occasions that the drift-ice is sufficiently extensive to reach the south side and surround the whole island. True icebergs are never seen ; the heavy masses often so called are small enough to float freely in comparatively shallow water, so that a cable would remain undisturbed at the bottom, the shore-end being carried up a fiord.

I trust you will adhere to the original intention of a land-line across Iceland to Faxø Bay, as by so doing you will avoid the only part of the sea where submarine volcanic disturbance may be suspected. Faxø Bay never freezes over ; and I find no record of drift-ice within it since 1683. Merchant vessels come and go throughout the winter.

From here the cable to Greenland will proceed. During the spring of the year South Greenland is usually enveloped with drift-ice and icebergs, whilst in the autumn it is for the most part free. It is, however, liable to be more or less obstructed throughout the whole year. The present, for instance, has been an extremely bad one, probably the worst for thirty years ; and yet the "Bulldog" (paddle steamer), the "Fox" (screw), and the Danish sailing-vessel have visited Julianshaab in September, October, and November.

My humble opinion is, that in two years out of every three the ice will be too inconsiderable to obstruct the laying down of a cable during the autumnal months ; whilst, in my official Report to the Hydrographer of the Navy, I have expressed a confident opinion that the shore-end may be carried into a fiord, where it will be secure from ice-bergs or drift-ice.

It only remains for me to notice Labrador. The landing-place for a shore-end there has yet to be sought for ; the interior, I was told, would present no difficulty whatever for a land-line.

The contour of the sea-bottom and depth of the ocean throughout the route is decidedly favourable. And here let

me inform you that my Report is misquoted in "The Engineer" of Friday last, the writer stating that I mention the soundings in one part as being "very irregular," whereas I reported them as "very regular."

You cannot have failed to derive much encouragement from the explorations of the "Bulldog" and "Fox."

There are difficulties, of course, in so great an undertaking, but they are not by any means insurmountable. To me it will always prove a source of real gratification to have been actively employed in the advancement of an object of such vast national importance.

You must take my opinion for no more than it is worth; you are well aware of its chief merit, an entire absence of prejudice or bias of any kind.

Should you desire it, I will be happy to explain to you in detail my grounds for every opinion, and authority for every fact which I have stated.

I am, my dear Sir Charles,

Faithfully yours,

F. LEOPOLD M'CLINTOCK.

TO SIR CHARLES BRIGHT,
&c. &c.

OPINIONS
OF THE
ROYAL DANISH COMMISSIONERS

APPOINTED TO TAKE PART IN THE SURVEYING EXPEDITIONS
OF 1860, BY THE MINISTER OF FINANCE OF HIS MAJESTY
THE KING OF DENMARK.

GOLDEN CROSS HOTEL, LONDON,
December 26th, 1860.

GENTLEMEN,

The undersigned, appointed as Delegates from the Royal Danish Government to join the North Atlantic Telegraph Expedition steam-yacht "Fox," commanded by Captain Allen Young, hereby state that—

We made the voyage with the "Fox," and one or the other of us took part in the land and sea expeditions respectively.

We concur in the opinion that it is practicable to submerge or land telegraph cables at the places selected on the Farøe Islands, and also to construct a line overland there; and that, in our opinion, cables, when landed, will remain undisturbed.

We have the same opinion in regard to the landing and maintaining cables on the coast of Iceland, and also that a line can be constructed across Iceland with all reasonable prospects of permanency.

As regards Greenland, we give it as our decided opinion,

based upon our own observations and information received from the best authorities, that cables can be safely laid from Greenland during the autumn months, for instance, at the Igalikko (Julianshaab) Fiord, where cables can be submerged beyond the reach of icebergs.

We are, my dear Sirs,
Your most humble and
Obedient Servants,

TH. VON ZEILAU,
Royal Danish Army.

ARNLJO'TR OLAFSSON,
Member of the Icelandic Diet.

To JOSEPH R. CROSEY, Esq., and others,
Promoters of the
NORTH ATLANTIC TELEGRAPH.

REMARKS
ON
GREENLAND AND ITS ICE,

IN REFERENCE TO THE NORTH ATLANTIC TELEGRAPH.

By J. W. TAYLER, F.G.S.

GENTLEMEN,

Having been requested to state my opinion as to the suitability of the coast of Greenland for the landing of the Atlantic Telegraph Cable, and also to give some information relative to the physical characters of the region, more particularly in reference to the ice, the difficulties it will offer, and the best means of avoiding them by the proper choice of a landing-place for the cable, I will, before proceeding, state that, in offering the few following remarks, I am actuated solely by a sincere desire to assist, so far as may be in my power, the success of such a beneficial and brilliant project as the connection of the two hemispheres; and that beyond this I have not the honour of being in anywise connected with this noble undertaking.

The facts and remarks which I am about to offer do not proceed from few or hasty observations, but are the results of nearly seven years' experience—that being the time during which I have actually resided in Greenland, in the winter as well as the summer; the whole of this period, with the exception of the first six months, having been passed in South

Greenland, and near the district in which the cable can be landed with the greatest advantage. I may therefore affirm that the facts I offer are by no means exceptional cases, which may be seen on one voyage and not on another, but that they will present to my readers a fair idea of the *average* state of the ice around and upon the coast of Greenland, as observed in my explorations of South Greenland. These explorations were carried on in boats along the coast, amongst the ice and between it and the land, and sometimes over the former, journeying up all the fiords, and by making incursions into the interior up to the edge of the continental ice, under which the last traces of the land disappear.

I may also state that I have frequently mounted the glaciers, and made short journeys over them.

As it would not perhaps be deemed advisable to land the wires to the north of Julianshaab, I will confine my remarks to the fiords of that colony and the district to the south of it. The physical characters of this region are as follows: mountainous land, having an average elevation of about 1500 feet for the more elevated parts, and an average of about 500 feet for the lower. The land is intersected in a north-easterly and south-westerly direction by deep valleys, forming navigable fiords (except when filled up by glaciers now extinct), and varying in length from 5 to 50 or more miles, and in breadth from 1 to 8 miles. The mountains on either side of these fiords are generally very steep, and in some places quite perpendicular and inaccessible. Other valleys above the level of the sea, and sloping upwards, intersect these in cross directions, thus dividing the land into a number of semi-isolated mountains, and affording a means of penetrating into the interior. At the extremity of these fiords, the land generally disappears under the ice, which covers, so far as we know, the whole of the interior of Greenland. This ice in many of the fiords runs out into the water, constituting the glaciers which produce *icebergs*.

The lower lands and flatter slopes of the mountains are for the most part covered with vegetation, consisting principally of moss, small shrubs, and occasionally grass. Small streams run through the valleys, fed in some places by springs, but more generally resulting from the melted snow and ice. Fresh-water lakes are also very frequently met with in the hollows between the mountains. The higher lands show less vegetation, and the surface of the rocks composing them are for the most part split and fractured by the alternate action of frost and thaw. Great quantities of loose blocks of stone, thus detached, cover the slopes of the mountains, and encumber the valleys.

As might be expected from the great height of the land, the water around the coast of Greenland is in general of very great depth, even close up to the rocks, so much so that vessels can only anchor close to the rocks in small coves. The coast is studded with islands, some of which have an altitude exceeding 1200 feet. There are, as might be expected, some few reefs, which, though not common, render necessary great caution and acquaintance with the coast on the part of those whose duty it may be to determine the spot most adapted to the landing of the Telegraph Cable. I know that places do exist in Greenland at which the cable can be brought to land from depths of water so great as to preclude the possibility of icebergs grounding upon it. Such places may be found between lat. 60° N., and $60^{\circ} 20'$; for example, Tessermiut Fiord, the large island of Sermisok, remarkable for the perpendicular cliffs at its southern extremity, and several other places where the rocks are nearly perpendicular, and frequented by the birds in the breeding season.

Three kinds of ice may be seen in Greenland :—

1st. The comparatively thin ice formed in the fiords of West Greenland during the winter. As the cable could be sunk into a groove in the rock, either natural or artificial, and filled

in with strong cement, no danger is to be apprehended from this kind of ice. It only forms in calm weather, during at the most four months of the year, generally but in January and February; some fiords more open to the sea seldom or never freeze.

2nd. The floe, or Spitzbergen ice, which is formed around the coasts of Spitzbergen and North-east Greenland during the winter. This ice attains a thickness which allows it to float above the water about 2 to 6 feet. From its great quantity, and size of its flat masses, it causes the principal impediment to navigation; but as it draws at most but about 20 feet, it can never injure the cable when once laid at the bottom of the sea.

3rd. The icebergs, majestic floating islands of ice, as extraordinary in their vast size as they are picturesque in their shapes and appearance. This ice differs from the two former in being produced on land, whilst the others are products of the sea. They are in fact portions of the continental ice, which owes its origin solely to the snow and rain falling upon the country. The icebergs are formed by the continental ice shooting out arms or glaciers into the fiords. The ice, owing to some cause not yet properly understood, has a very slow motion from the interior outwards towards the sea-coast; when, therefore, it projects itself by these arms or glaciers into the sea, it breaks off either by its own weight, or owing to the rifts which may be seen in the glacier; and with a noise equalling sometimes the discharge of a broadside, the iceberg is launched, which, after rolling and plunging, at last recovers its equilibrium, and floats away with its brethren out of the fiord and up the Davis Strait.

The greater portion and the largest of these icebergs owe their origin to the glaciers of Spitzbergen and the north-eastern part of Greenland; those formed on the south-west of Greenland being icebergs of smaller dimensions and comparatively few in number, the reason of which may be seen by inspecting

a map of the country, showing the limits of the continental ice, which will show that this continental ice is there much more distant from the sea, and that the width of the fiords at their junction with that ice is not sufficiently great to admit of icebergs of large dimensions being produced in the south-west portions of Greenland. The icebergs, therefore, which are formed in the fiords of South-west Greenland do not ground except in the shallower parts of the fiords; and in the deeper parts there is no possibility of icebergs grounding in the depth of water in which the cable would be laid.

Icebergs occasionally contain large boulders and earthy matter; and some anxiety may be perhaps felt as to the effect upon the cable of large boulders, separated from the iceberg by thawing or breaking up of the berg, and sinking upon the cable. In the first place, not one berg in a thousand is seen to contain boulders; in the second place, the temperature of the water is so near the freezing point that but little of the bergs is melted on their passage round South Greenland; and, in the third place, should such a thing occur, and a large boulder sink and fall upon the wire, I do not imagine that it would produce the least ill effect, since its specific gravity is but about 2.5; and all who have sounded in deep water know how slowly a body, even lead, sinks in very deep water. It therefore appears, that no boulders detached from icebergs can ever injure the cables.

It is well known that a current exists, whose course is down the east coast of Greenland to the southward, round Cape Farewell, and running northward up its western coast. It is to this current that West Greenland owes its ice; for the bergs launched into the sea from the western fiords are but comparatively few, and would never of themselves suffice to impede the navigation or hinder the approach of vessels at any time to this coast; but this current brings with it the floe ice and the icebergs of Spitzbergen and the east coast, which, uniting with the ice of the west coast, produce that

vast quantity of drifting-ice which, at certain periods of the year, offers such impediments to navigation, and which, with westerly winds, enter and sometimes fill the fiords.

Fortunately, this stream of ice is not generally capricious in its arrival or its departure, although in some seasons its quantity is increased and its presence on the coast protracted over longer periods. Such was the case in the summer of the present year (1860); it was, in fact, quite an exceptional season in regard to the quantity and long continuance of the ice upon the west coast of Greenland. During my residence of seven years I have not seen the ice in such quantity nor continued so long upon the coast. Several intelligent Danish inhabitants of the colonies informed me that more than 30 years had elapsed since there had been so much ice seen there and remaining so long. It is to this fact that the account of the state of the ice on the coast of Greenland, as given last year by Colonel Shaffner, appeared to the expedition per "Bulldog," to differ so much from their own observations made this summer. It is during the early part of the year and summer that the drifting-ice makes its appearance on the west coast of Greenland, usually coming slowly round Cape Farewell in the end of January or beginning of February, reaching Julianshaab in that month, and continuing to pass that place until the middle of September, when the ice stream gradually diminishes, until in the month of October the sea becomes free from ice, so much so, that but one or two straggling bergs can be seen from the highest mountains; whereas, when the ice is at the worst, no open water can be seen from the same height. These are the general conditions of the ice on the west coast of Greenland, and all others are exceptional cases.

The ice-stream, after reaching to about the latitude of Fiskernaes, keeps further off from the land, and scatters and opens, so that about Godthaab, Holsteinberg, and the district to the north, the coast is almost always accessible, even when

the more southern parts are quite blocked up with ice. Godthaab and Frederickshaab are also generally easy of access, and were it not desirable to render the length of the cable between Iceland and Greenland as short as possible, the neighbourhood of Godthaab would offer great advantages in being so free from ice during the summer.

It is, however, unnecessary to fear any impediments as regards the ice to laying the cable, for the reason that the cable would not be laid to Greenland, but on the contrary would be taken from thence to Iceland, round Cape Farewell on the one side, and to Labrador on the other.

I should propose that the cables, coiled in powerful steamers, should be sent to Greenland early in the season (May), making Frederickshaab first if much ice should be seen at the south; they should be accompanied by a steam-tender and transports with coal. Having reached Frederickshaab they could make their way southward between the land and the ice (which is sometimes several miles distant) until they reached the harbour near the spot to be previously examined and chosen as the landing-place, or rather starting-place, of the cable. They could there await the ceasing of the ice-stream, or as sometimes occurs, a partial clearance favourable to the exit of the steamers. When this has occurred, and the sea appears open, the tenders should be immediately sent out to a distance of 200 miles from the coast, for the purpose of ascertaining if any other stream of ice exists out to sea, as occasionally happens. If clear they would return, and the steamers bearing the cables could then come out and lay the wires with perfect safety, since after making that distance from the coast all danger from the ice ceases.

It is not my intention to deny the dangers of the ice; I admit them to the fullest extent. I admit that vast quantities of ice are to be met with on the coast of Greenland, but there is also a time when the sea is perfectly free from ice. I admit that icebergs draw much water, but I know that the water is

very much deeper, and that they cannot ground in the track of the cable. In fact, I maintain that as regards the land and ice of Greenland, there will be experienced no greater difficulties than in laying a cable of equal length in any other part of the globe, provided of course that every prudent precaution be taken in the choice of the proper season and locality for landing the cable in Greenland.

J. W. TAYLER.

TO JOSEPH R. CROSKY, Esq., and others,
Promoters of the
NORTH ATLANTIC TELEGRAPH.

APPENDIX.

OPINIONS OF GREENLANDERS ON THE PRACTICABILITY OF LAYING THE TELEGRAPHIC CABLES UPON THE COAST OF SOUTH GREENLAND.

THE following extracts are taken from letters written in Greenland by residents there, who have had much experience upon the coast. They prove that the floe-ice is seen off the coast of Julianshaab in January or February, and that sometimes during the summer months there is none off the coast, and that every year, from and after the month of August until January, "the coast is free from ice." During the months that are free from ice a steamer can enter or depart with the cable, and lay it without the slightest interruption. The floe-ice runs north, along and within sight of the coast, unless driven to sea by extraordinary gales, which circumstance is always known. When it is driven to sea it clusters together in small patches of a few hundred yards in length.

The year 1860 was a remarkable era; there was a greater quantity of ice, and it remained longer upon the coast, than ever before within the memory of man or traditional accounts. Even during this year the cables could have been safely landed in Julianshaab and other fiords. Severe seasons occasionally occur in all climates, and so it has been in England the present winter (1861). The first fourteen days were colder than has been experienced since 1839, and it has been the third occurrence of severe cold within this century.

*Extracts from a Letter dated Godthaab, Greenland, September 4th, 1860,
from Dr. Rink, Inspector (Governor) of South Greenland.*

"I need not tell you how interesting your letter from Julianshaab, of October, last year, was to me, and how much I regretted the impossibility of meeting you.

"I have thought much on your grand enterprise, and though I doubt very much that the telegraph line can be carried across Greenland from the east side, I am convinced that it can be landed in some of the inlets (or fiords) in the vicinity of Cape Farewell, without fear of interruption from ice.

"The drift ice has been very bad this summer, and has deprived me of an opportunity to meet you."

Extracts from a Letter dated Julianshaab, November 2nd, 1860, from Mr. Müller, Governor of the Julianshaab District, a resident of Greenland since 1825.

"As a general rule the first drift ice appears in the months of January or February, but it is seldom of such extent as to reach further north than this district. When it does so, it is in the spring months.

"The Spitzbergen ice this year (1860) has beset the coast of this district from the month of January, but at some times not so much as to prevent vessels coming into this port.

"The worst months were June and July and a part of August. The reason that Col. Shaffner's vessel was able to run into this port so successfully in the autumn of last year (October 2nd, 1859), was that the ice had long before entirely left the coast; in fact, the ice had gone away in August.

"The Colonel's ship, without the slightest hindrance, navigated the coast in the month of September, and put to sea from near this harbour in October, 1859. But this year the ice has remained upon the coast longer than ever before within my memory. The coast is usually free from ice during the autumn months."

Extracts from a Letter dated Frederickshaab, October 11th, 1860, from Mr. Twede, Governor of the Frederickshaab District, a resident of Greenland since 1850.

"The ice off this coast has continued later this year than it has ever before during my residence in Greenland. During the past ten years, and before this season, the ice on the coast of this and the Julianshaab districts, with but one exception, has never prevented the Julianshaab vessels from sailing direct to this place, and they have generally arrived

by the middle of August, and in 1855 on the 5th of July. Last year the vessels proceeded direct from sea to Julianshaab, the ice having disappeared off the coast early in the summer.

“In September, 1855, I sailed along the coast of Julianshaab District beyond Cape Farewell to Itiblik, without having encountered any floe-ice whatever. In September, 1859, Col. Shaffner's ship was seen steering along the coast, and subsequently anchored at Kaksimiut, in the Julianshaab District, without any interruption from ice. The coast during the autumn months is nearly always free from ice.”

Extract from a Letter dated Frederickshaab, October 11th, 1860, from the Rev. F. P. Barfoed, a resident of Greenland since 1852.

“During my residence in Greenland, I have never seen so much ice as during the present year. Dr. Rink, the Inspector (Governor) of South Greenland, and all other Danes and Greenlanders with whom I have consulted on the subject, are unanimous in declaring that never before within the memory of man has there been a year of so much ice as that of 1860.

“It is my opinion that both the east and the west coasts are every year, at times, free from ice, but possibly not on both coasts at the same time; and it is my decided opinion that a steamer will almost always find an opportunity to proceed unobstructed, direct from and to Julianshaab District, either from or to Labrador and Iceland, after, and many times during, the month of August. In the month of September, 1859, I saw Col. Shaffner's vessel coasting southward, and in a few days afterwards we heard that he had anchored at Kaksimiut in the Julianshaab District. There was but little ice last year, and in an especial manner was the Julianshaab District free from ice.”

Statement of Mr. Motzfeldt, Superintendent at Kaksimiut, one of the oldest residents in Greenland, November, 1860.

“The year 1860 has been one of the worst ice years that we have ever had. Last year (October 2nd, 1859), Col. Shaffner's ship entered Kaksimiut without difficulty. In the months of September, October, and November, generally, this coast is free from ice, and a steam vessel can enter from the sea and depart from the coast almost any day, and

not be interrupted during the autumn months. I am now over fifty years of age, and do not remember ever having seen an ice year as bad as this (1860). Even this year the coast of the Julianshaab District has been free from ice during the past and present months."

Extract from a Letter dated Julianshaab, November 3rd, 1860, from J. Anderson, Captain in the Royal Greenland Commercial Service since 1848.

"During eight years I was boatswain to a merchant vessel trading to this district, and during the last twelve years commander of the district schooner 'Activ,' of 22 tons burthen. During those periods, I have as an old sailor (for I have been forty years at sea) made many careful observations as to the nature of the ice along this coast. I have also kept a correct log book (which is now in the possession of the Board of Management of the Royal Danish Commercial Institution of Greenland), ever since the year 1849.

"Having gone through that log book, and compared it with my own views, I now express the opinion that, as a general rule, the ice mostly lies on the coast during the months of April and May, and that, on the other hand, the months which are free from ice are September, October, and November. It may be taken as a general rule, that during the months of September and October, even in what are called 'bad ice years,' this coast is free from ice.

"My own experience enables me to state positively—and my log book will bear me out in the statement—that steam-vessels can run straight into the settlement from the sea, with certainty, during the months before mentioned; and, as a proof of the correctness of this opinion, reference may be made to this very year, which, in regard to ice, to my own knowledge, has been the worst and the longest in duration of any 'bad ice year' since my arrival here in the year 1841. The large vessel, 'Bulldog,' came straight to this place from sea; and since the date of its arrival, up to the present time, any ship, be it what it may, might have been equally able to make this port from the sea, and to leave it again without interruption from ice.

"Last year (1859) an American barque came straight into Kak-simiut, which is a little to the north of this settlement; but that is not to be wondered at, as last year was what we call here an 'ice-free year;' and if the captain of that vessel had been acquainted with the coast

navigation, he might have easily come in and gone out more than twenty times and from as many places."

Extract from a Letter dated Julianshaab, October 23rd, 1860, from Mr. Dorph, retired assistant from Nennortalik; I. Holm, superintendent at Sardlok; M. Schonheyder, superintendent at East Proven; and S. G. Lund, superintendent at South Proven.

"In compliance with the request made to us, we hereby declare that the present year has been what is called in Greenland a 'bad ice year.'

"The large ice remained an unusually long time at the shore. Neither of us, nor any of the old Greenlanders with whom we have conversed on the subject, remember ever having seen, in the course of our lives, the ice remaining for so long a period along the coasts.

"The ice lay so thick for so long a time that the hunters were prevented thereby from performing their usual work, even in their Kayaks. In the present year the ice set in from the first month, and remained until September, when it disappeared. This coast is usually free from ice during the autumn months, and vessels can enter and depart without interruption from ice.

"One of the undersigned, Mr. Dorph, who has resided in this district during forty-one years, remembers well the year 1825, which was a remarkable 'bad ice year,' but it was not such a 'bad' one as the year 1860."

Extract from a Letter dated Frederickshaab, October 12th, 1860, from T. Ordrorpe and C. Fotel, Captains of Vessels from Denmark.

"On the 19th of June (1860), at about eight miles from land off Cape Farewell, we found much ice; on the 22nd, off Julianshaab, there was no ice. The ice was in patches, more north, and the greater part of our voyage on the coast, it was near to land. We were informed by the old people of Godthaab, that during the past thirty years there has not been any year with as much ice on the Greenland coast as the present, 1860."

LANDING PLACES AND LENGTHS OF CIRCUITS.

SCOTLAND TO FARÖE ISLES.—One end of the cable for this section will be landed in North Scotland, the other end in a bay near Thors-haven. This section will be some 225 miles, and the depth of the sea not exceeding 254 fathoms ; bottom, mud and shells.

FARÖES TO ICELAND.—One end of the cable will probably be landed at Haldervig, near the north of Stromöe Isle. Captain Young strongly recommends this bay, and that the other end be landed in Beruford, Iceland, a very good place, with deep water and muddy bottom. The cable to this place will be about 240 miles. Depth of sea, maximum, 683 fathoms ; bottom, mud and shells. It may be found more advantageous to carry the cable more westward, to or near Portland, and to which place it can be laid on a muddy and sandy bottom, in water of good depth. Both of these places have always been free from volcanic influences.

ICELAND TO GREENLAND.—This section will be the longest of the series, between 600 and 700 miles. Captain Young has reported in favour of Hvalfiord, a little north of Reikiavik, but it is quite probable that a more westerly place will be selected, on the south side of Faxa Bay. The other end of the cable he recommends to be landed in Julian-shaab fiord, on the south-west coast of Greenland. He examined that beautiful fiord, and found it to contain deep water, with muddy bottom ; and he states that it is his decided opinion that bergs cannot reach the cable when laid in it. The reports of others concur in this opinion. There are other fiords, near Cape Farewell, equally favourable. Tesser-miut and Illoa fiords are considered well suited for the cables.

Heretofore it was contemplated to land this section of the cable upon the east coast of Greenland, south of latitude 61° north, in or near Prince Christian's sound, and then, either to carry the cable out at the

other end of the sound, or to connect this section with the next by a cable around Cape Farewell ; or, by a line across the land, avoiding the inland ice. It is now proposed to carry the cable from Iceland, around Cape Farewell, to one of the fiords on the west side, and from the same fiord run the cable to Labrador.

GREENLAND TO LABRADOR.—The cable will start from Greenland, and land at or near Hamilton Inlet. The soundings taken by Sir Leopold M'Clintock show 180 fathoms interior from the outer rocks on the coast, so that the cable can be laid into the inlet from the sea in water sufficiently deep to place the cable beyond the reach of icebergs. If, however, the depths be found more favourable from the sea into Byron's Bay, near and north of Hamilton Inlet, that place will be equally satisfactory, all questions being considered. Length of section, about 510 miles.

Before the respective cables are laid, each of the places will be carefully sounded, and buoys will be placed, indicating the deep trenches ; and, besides, steam tenders will be in readiness to serve as pilots.

PROFILE OF THE SEA SECTIONS OF THE NORTH ATLANTIC TELEGRAPH.

[*From the Mechanics' Magazine, London, Feb. 15th, 1861.*]

At the last meetings of the Royal Geographical Society the subject discussed was the North Atlantic Telegraph.

Among the speakers on that interesting occasion was Captain Sherard Osborn, R.N., the distinguished Arctic navigator. He first called the attention of the Society to the bottom of Hamilton Inlet, and stated that it was mud and shells. He thought there was every reason to believe that a cable once laid in that inlet would not be disturbed by icebergs. But the most striking part of this navigator's remarks was that which referred to the favourable depths of the respective deep seas ; and in order to enable our readers to understand his ideas, we have had engraved the accompanying diagrams. Captain Osborn observed that the section between Scotland and the Farøe Islands was comparatively shallow. The deepest water found was but 254 fathoms, and the depths seem to be very uniform. The sea between the Farøe Isles and Iceland is deeper, but not exceeding 683 fathoms. On these two sections the depths are so moderate that the cables can be taken up and repaired if they should get out of order ; and this fact is one of very great commercial importance.

The next section is between Iceland and Greenland. This is the longest on the route, but at the same time its depths are very favourable. The deepest water is 1572 fathoms.

There is but a short distance of this section over 1200 fathoms, and practical telegraph engineers seem to agree that a cable can be raised at that depth. In 1858 the Atlantic cable was let out in 2600 fathoms of water, with a lead over 100 lbs. weight attached, and it was drawn back again. We are informed that it is contemplated to submerge cables upon this route that can be taken up and repaired ; and it is believed that it will be possible to take up the entire line between Iceland and Greenland.

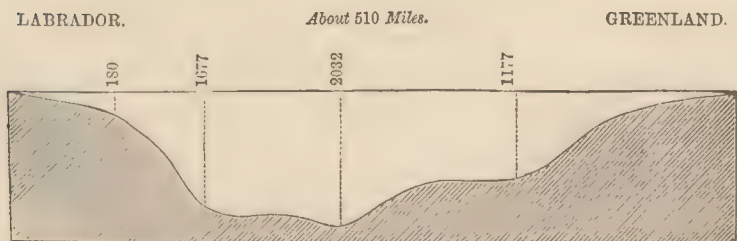
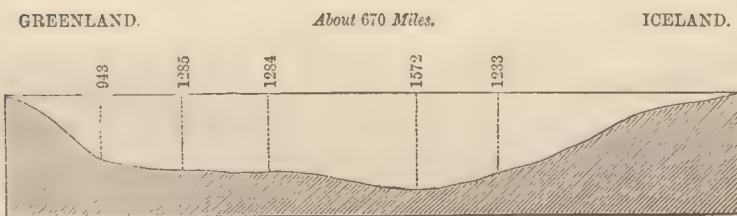
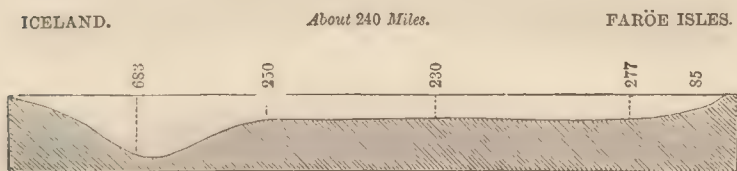
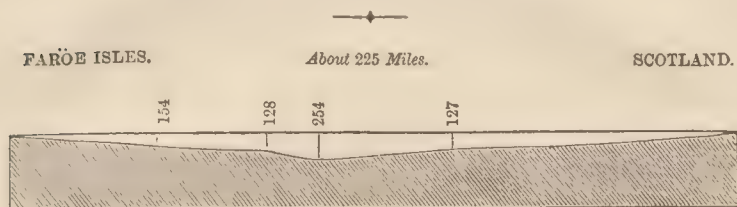
The deepest section is between Greenland and Labrador, which at its greatest depth is 2032 fathoms.

PROFILES OF THE DEEP SEAS

ON THE

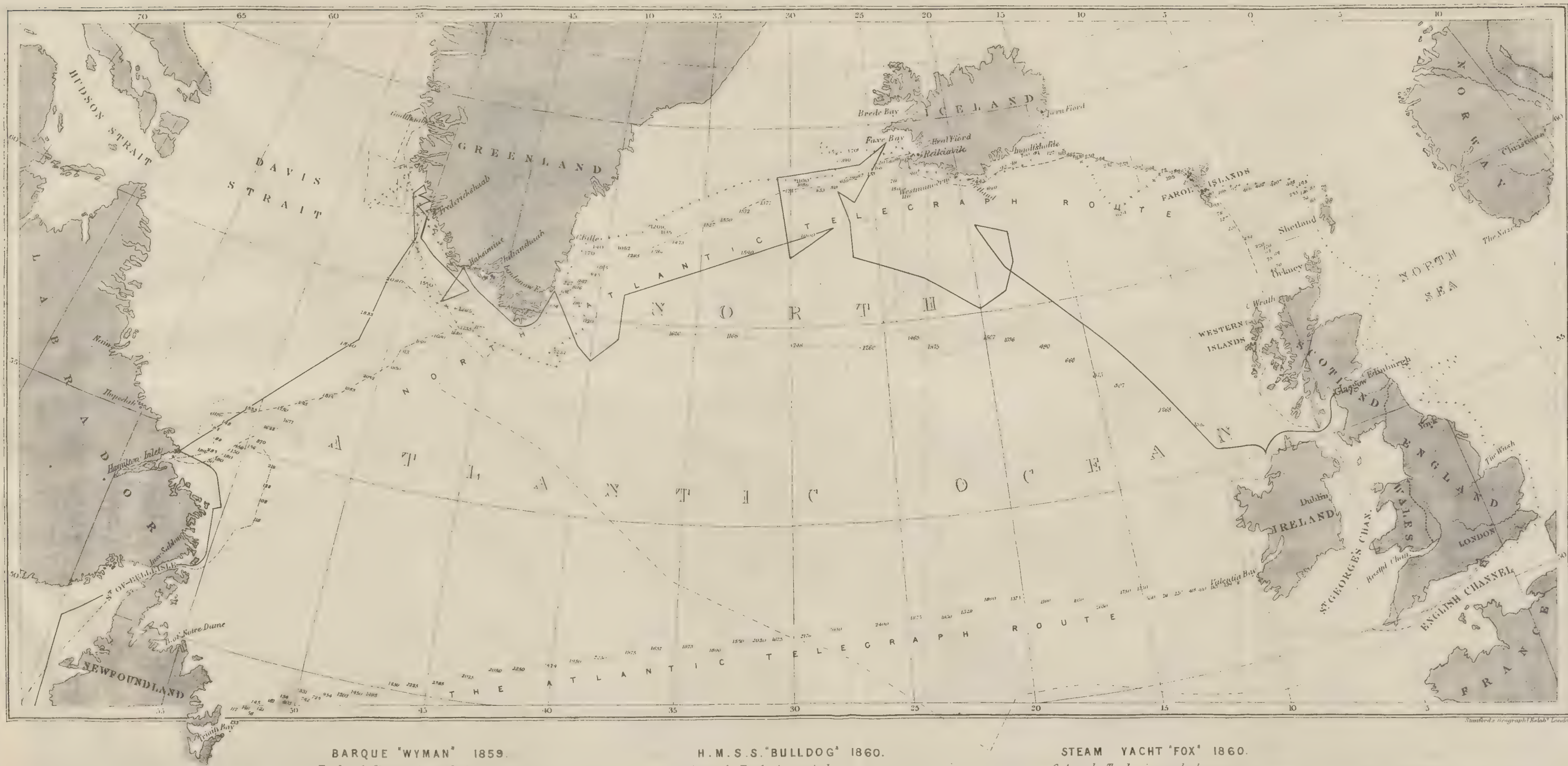
NORTH ATLANTIC TELEGRAPH ROUTE.

According to the soundings taken by the "Wyman," the "Bulldog," and the "Fox" Expeditions of 1859 and 1860.



LONDON:
BRADBURY AND EVANS, PRINTERS, WHITEFRIARS.

TRACKS OF THE NORTH ATLANTIC TELEGRAPH EXPEDITIONS OF 1859 AND 1860.

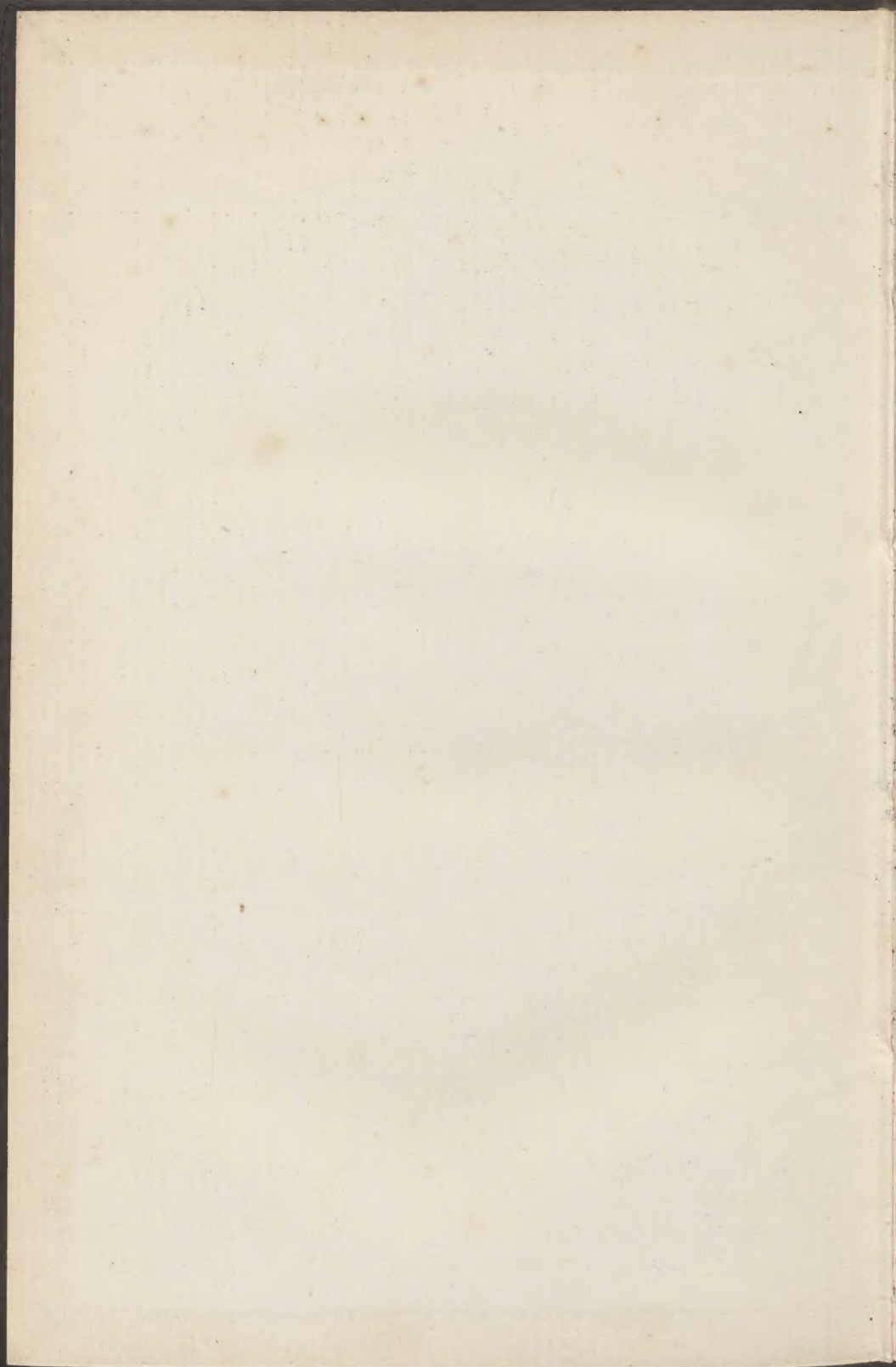


BARQUE "WYMAN" 1859.
Track of Voyage is marked ———

H.M.S.S. "BULLDOG" 1860.
Outward Track is marked - - - - -
Homeward, ———

STEAM YACHT "FOX" 1860.
Outward Track is marked + + + + +
Homeward, ———





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